Industrial Conductivity Meter
HE-480C

Instruction Manual

CODE:M500772A(I1002576000A)

Introduction

Thank you for your purchasing of our industrial conductivity meter HE-480C.
This instruction manual describes the operation of the Industrial conductivity meter, HE-480C.
Be sure to read this manual before using the product to ensure proper and safe operation of the instrument.
Also safely store the manual so it is readily available whenever necessary.

Product specifications and appearance, as well as the contents of this manual are subject to change without notice.

■ Warranty and Responsibility

The product delivered to you is covered by HORIBA Advanced Techno's warranty for a period of one (1) year.
If any malfunction or damage attributable to HORIBA Advanced Techno's responsibility should occur during this period, necessary repairs or replacement of parts shall be made free of charge by HORIBA Advanced Techno.
The warranty does not cover the following:

- Any malfunction attributable to improper operation
- Any malfunction attributable to repair or modification by any party not authorized by HORIBA Advanced Techno
- Any malfunction attributable to the use in an improper environment
- Any malfunction attributable to violation of the instructions in this manual
- Any malfunction attributable to operations in the manner not specified in this manual
- Any malfunction attributable to natural disasters, or accidents or mishaps not involving HORIBA Advanced Techno
- Any deterioration in appearance attributable to corrosion, rust, and so on.
- Consumables and replacement of consumables
- Products of other companies

HORIBA Advanced Techno shall not be liable for any damages resulting from any malfunctions of this product, any erasure of data, or any other uses of this product.

■ Trademarks

Generally, company names and brand names are either registered trademarks or trademarks of the respective companies.

Conformable Directive

This equipment conforms to the following directives and standards;

Directives: The EMC Directives 89/336/EEC in accordance with Article 10 (1) of the Directive.
The Low Voltage Directive 73/23/EEC

Standard: [The EMC Directive] EN61326: 1997 + A1: 1998 + A2: 2001
(Emission: Class A, Immunity: for Industry location)
[The Low Voltage Directive] EN61010-1: 2001
This equipment shall not be used in the residential, commercial and light-industrial environment.

Note

If the sensor cable, transmission cable, or junction cable is extended to 30 m or longer, this product does not conform with the serge immunity specified in the EMC directives.

FCC rules

■ WARNING

This equipment has been tested and found to comply with the limits a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provided reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and radiates radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Installation Environment

- Pollution Degree2

Safety Policy

● **Meaning of signal words**

Warning: This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Caution: This indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Mandatory: This indicates actions you are required to do. The actual content of requirement is described using figures and text along with pictographs.

Prohibited: This indicates actions you are prohibited to do. The actual content of prohibition is described using figures and text along with pictographs.

■ Notational conventions used in this manual

Notes and cautions are described in the following styles in this manual:

Warning

Electric Shock

Make sure that no electric power is supplied to the instrument before starting this work.
Do not turn on the power until your work is completed.

Caution

When the instrument is turned off, the C-NC contact is shorted. Be careful when connecting a load.

Mandatory

To connect a load beyond the contact capacity or use inductive load (such as a motor, or pump), be sure to use a power relay whose rating is higher than the load.

Prohibited

Do not operate the keys or push the panel surface with a sharp object, such as the fingernail.

■ Glossary

For explaining the operation of the converter, the following terms are being used.

Term	Explanation
Long press	To hold down the object until the lamp lights or the display changes.
Single press	To lightly press the object once.
Flash	To flicker quickly several times, and the setting is established.

Contents

1 Overview 1

1.1 Components 2
1.1.1 Operation keys 3
1.1.2 Indicator lamps 4
1.2 Operation modes and menus 5
1.3 Specifications 7

2 Installation 9

2.1 Installation environment 9
2.2 Installation procedure 10
2.3 Connection 12
2.3.1 Connecting the contact outputs 12
2.3.2 Connecting the sensor cable 13
2.3.3 Connecting the transmission output cable 14
2.3.4 Connecting the power supply 15
2.3.5 Attaching the terminal covers 15

3 Preparation 16

4 Measurement 19

4.1 Measurement 19
4.2 Basic settings 19
4.2.1 Sensor setting 21
4.2.2 Measurement condition 24
4.2.3 Display method 29
4.2.4 Contact output 31
4.2.5 Transmission output 40
4.3 Calibration 43
4.3.1 Temperature calibration 44
4.3.2 Adjustment of compensation coefficient for conductivity zero point (Adjust) 44
4.3.3 Adjustment of compensation coefficient for cell constant (Span) . . . 45
4.4 Control value setup menu 46
4.5 Security menu 48
4.5.1 Key lock 48
4.5.2 Password locking 49
4.6 User check menu 51
4.6.1 Status check 51
4.6.2 Instrument reset 52

5 For More Accurate Measurements 53

5.1 Daily calibration (calibration mode) 53

5.2 Maintenance for the instrument body 53

5.2.1 Inspection of the meter 53

6 Troubleshooting 54

6.1 Troubleshooting 54

6.2 Out of the measurement range 55

6.3 Error code 56

6.3.1 Description of error codes 56

6.3.2 Remedies for error codes 57

7 Parts list 58

7.1 Options 58

7.2 Consumables 59

1 Overview

Outline

- IP65 (dust and water proof) panel.
- Selectable sub-display items, including current temperature.
- Concentrated control keys on the front panel for all settings.
- A rich set of maintenance features
- Free transmission output range
- Free power supply (100 V to 240 V AC, 50/60 Hz)
- Memory backup

Features

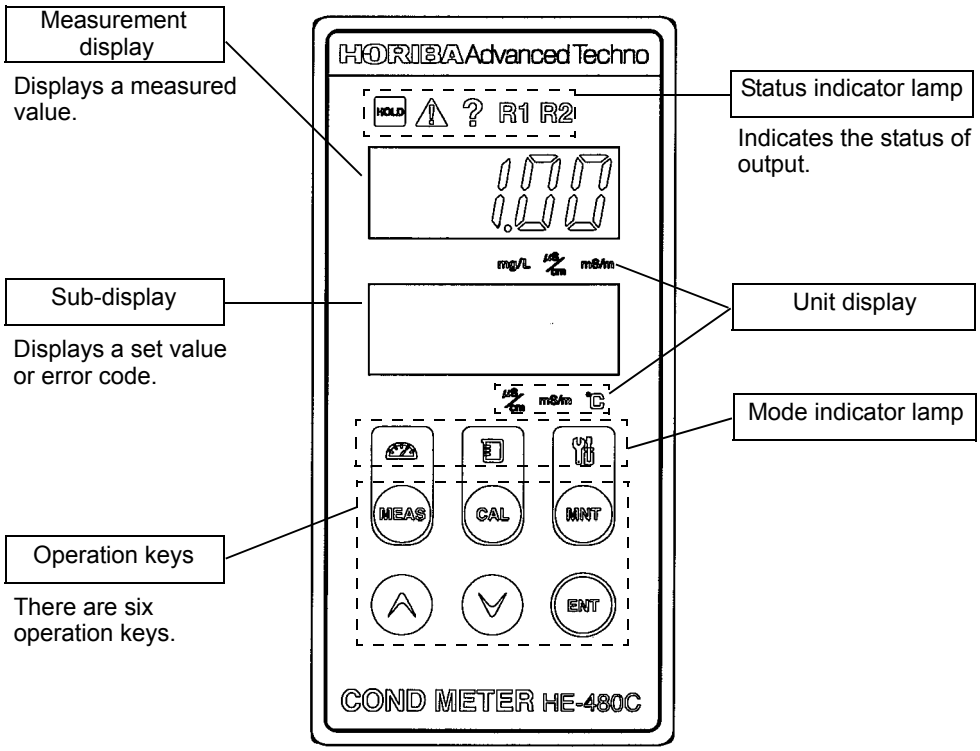
- Easy-to-read display (large characters)
- Improvement in operability of the keys using the embossed sheet
- Relaxed resistance limit of the loads to the transmission output (Max. 900 Ω)
  (250 Ω receiver × 3 + wiring resistance)

Special features

- Improved and expanded status display with icons.
- Downsized converter.
  The volume is reduced by 20% compared to its predecessor.
- Selectable between old-style units and SI units
- Equipped with the USP assessment feature (alarm output only)
- Capable of displaying TDS conversion values

1.1 Components

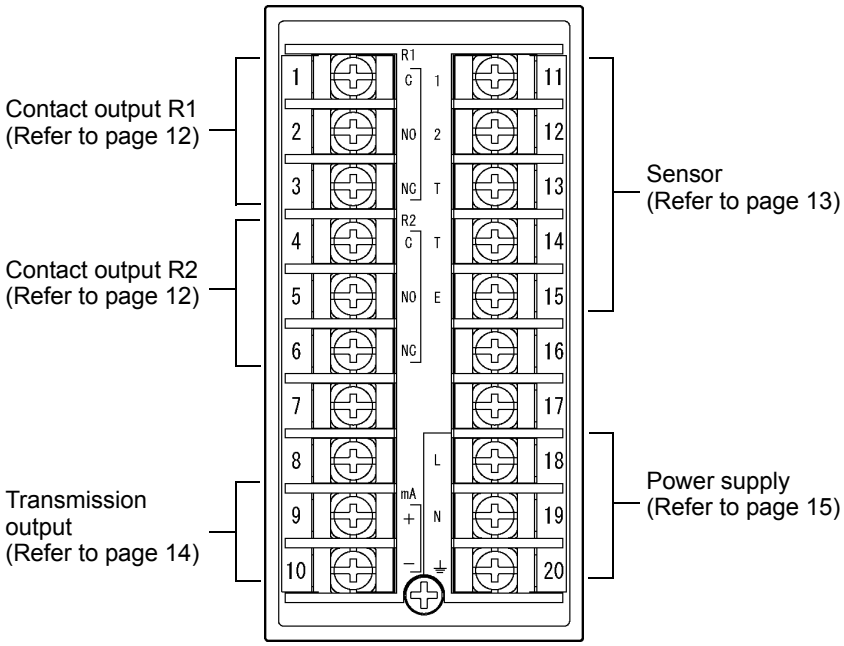
● Front panel



Prohibited

Do not operate the keys or push the panel surface with a sharp object, such as the fingernail.

● Terminal block



1.1.1 Operation keys

Operation keys are used to switch displays, enter settings, and perform calibration, etc.
You can change the value or item while the display is blinking.
Select a value or item using the UP/DOWN keys, and press the ENT key. And the display will flash, and the setting will be established.
To disabled the key operations use the security menu.

Key	Notations in the text (Meaning)	Description/Operation	
	MEAS key (Measurement)	Use this key to return to the measurement mode from another mode. In the setup menus of the measurement and maintenance modes, pressing once will cancel the last change and make the display return to the previous item. To return to the measurement mode, press this key repeatedly until the MEAS lamp lights up.	
	CAL key (Calibration)	Long press	Hold down this key until the CAL lamp lights up, and the calibration mode will be enabled.
	MNT key (Maintenance)	Single press	The control value setup menu will be enabled, and “Set” will be displayed.
		Long press	Hold down this key until the MNT lamp lights up and the MEAS lamp turns off, and the maintenance mode will be enabled.
	UP key DOWN key (Selection)	Use these keys to change the displayed value or item. For a numerical value, pressing once will increment/decrement the value by one count, and holding down the key will increase/decrease the value continuously. The UP key and the DOWN key scroll the display in the opposite directions. When you have pressed one of the buttons excessively, press the other key, to go back.	
	ENT key (Enter)	Use this key to establish set values and calibration values. **Note** **If you use the MEAS key instead of the ENT key to return to the previous menu, the last changes are cancelled.**	

1.1.2 Indicator lamps

● Mode display

	Measurement lamp Lights up during the measurement mode. This lamp is turned OFF during the calibration and maintenance modes, during which measurement is stopped.
	Calibration lamp Lights up during the calibration mode. To enter the calibration mode, hold down the CAL key until this lamp lights up. Calibration can be performed while this lamp lights up is being lit. Measurement is stopped in this state.
	Maintenance lamp Lights up during the maintenance mode. To enter the maintenance mode, hold down the MNT key until this lamp lights up. Setups can be made while this lamp lights up. Measurement is stopped in this state.

● Status display

	Lights up when the transmission output is held constant.
	Lights up when an alarm (FAIL) has been issued.
	Lights up when an error has occurred.
R1 R2	Lights up when the relevant contact output is ON (C-NO is conducted).

1.2 Operation modes and menus

This instrument has 3 operation modes and 5 menus in its major category.

- **Operation modes**

Measurement mode
Measurements and instrument control are performed.

Calibration mode
Calibration are performed.

Maintenance mode
Measurements and outputs are stopped, and performs various setups are performed.

- **Menu**

The following menus are provided under the measurement and maintenance mode.
For how to enter each of the modes and menus, see the respective description pages.

Basic setup menu
This menu allows you to set up all the parameters related to measurement, such as terminal allocation of detector information.

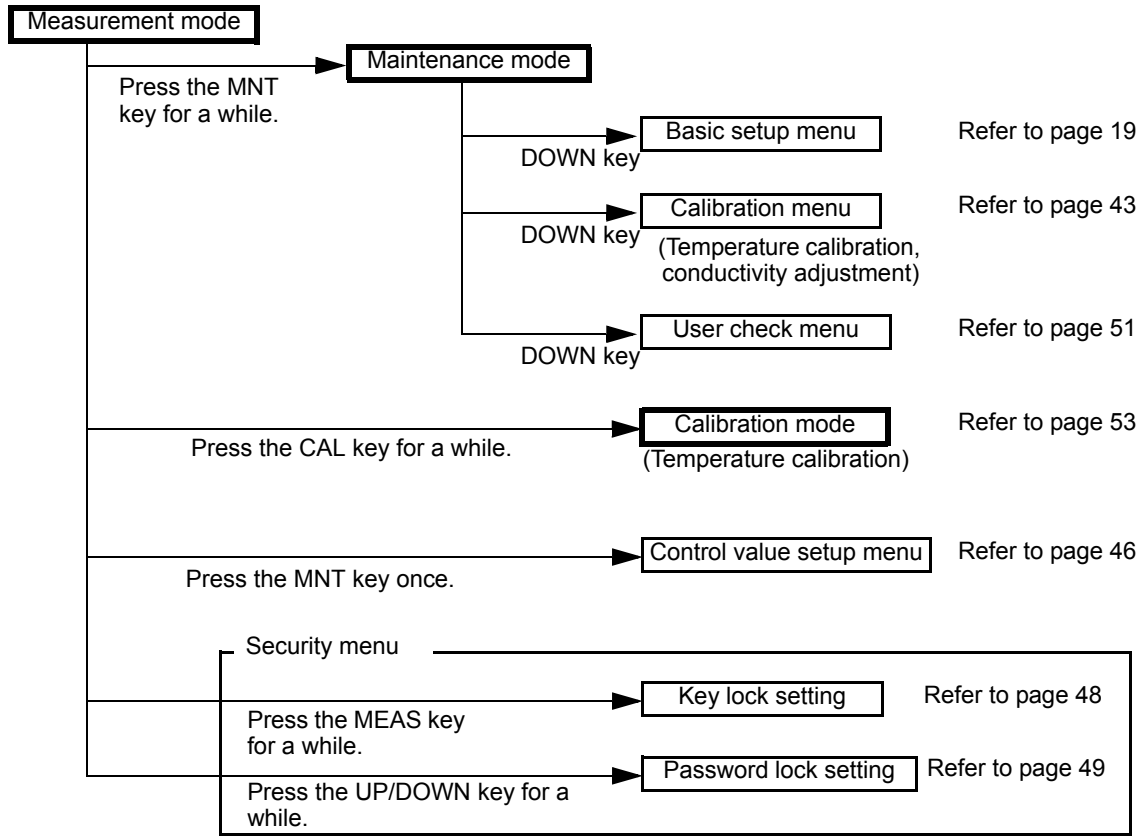
Calibration menu
This menu allows you to perform calibration.

User check menu
This menu allows you to check the output state or measured values, and to reset the set values to the factory settings.

Control value setup menu
This menu allows you to set or change control values while checking the output during measurement.

Security menu
This menu prevents you from wrong or illegal operation.

Modes and menus from the measurement mode



1.3 Specifications

Product name	Industrial conductivity meter			
Model	HE-480C			
Measurement method	Electrode type (2-electrode method)			
Cell constant	0.01/cm, 0.1/cm, or 1.0/cm			
Temperature sensor specifications	Platinum resistance 1000 Ω/0°C; temperature coefficient 3750 ppm/°C standard			
Measuring range	Cell constant (/cm)	0.01 (ESD/ESL-001)	0.1 (ESD/ESL-01)	1.0 (ESD/ESL-1)
	Measurement range (μS/cm)	2.000/20.00	20.00/200.0	200.0/2000
	Measurement range (mS/m)	0.2000/2.000	2.000/20.00	20.00/200.0
	TDS conversion (mg/L)	2.00/20.0	20.0/200	200/2000
	Temperature 0°C to 100°C			
Repeatability (in equivalent input)	Conductivity display	Within ±0.5% of the full scale		
	TDS conversion display	Within ±1.5% of the full scale		
Linearity (in equivalent input)	Conductivity display	Within ±0.5% of the full scale		
	TDS conversion display	Within ±1.5% of the full scale		
Transmission output	4 mA to 20 mA DC: input/output isolated type Maximum load resistance: 900 Ω Transmission output range: Freely selectable within the measurement range			
Contact output	Outputs: 2 points Alarm contact output (R1 and R2) Contact type: relay contact, SPDT (1c) Contact rating: 240 V AC, 3 A and 30 V DC, 3 A (resistance load) Contact function: selectable from upper/lower limit operation (ON/OFF control), alarm, and maintenance.			
Calibration function	Conductivity: Based on the specified compensation coefficient for the cell constant (parameter input) Temperature: Calibrated by comparing with the reference thermometer TDS: Conversion using a user-defined coefficient value (0.30 to 1.00)			
Transmission output hold feature	● Previous value hold ● Optional value hold ● Continuous Selectable from the above (However, only the previous value hold is available in the maintenance mode.)			
Self-diagnosis function	● Sensor diagnosis Short-circuit and disconnection of the temperature sensor ● Out of the measurement range ● A/D converter scale over ● Converter error			
Temperature compensation	● Based on the temperature characteristics of extra deionized water (reference temperature: 25°C) ● Based on the temperature characteristics of NaCl ● Based on the reference temperature and user-defined temperature coefficient (reference temperature: 5°C to 95°C, temperature coefficient ±5%/°C) ● No temperature compensation			

Temperature-compensated range	0°C to 100°C	
Ambient temperature	-5°C to 45°C	
Relative humidity	20% to 85% (without dew condensation)	
Storage temperature	-25°C to 65°C	
Power supply	Rated voltage 100 V to 240 V AC, 50/60 Hz, 10 VA (max.)	
Structure	Indoor-use panel installation type Panel case: ABS, Terminal: PBT Panel: IP65 dust and water proof structure	
Protective structure	Panel: IP65 (IEC60529, JIS C0920) Rear case: IP20, Terminal:IP00 Class II device (IEC61010-1) Pollution level 2 (IEC61010-1)	
Conforming standards	CE Marking	EMC Directive (89/336/EEC) EN61326: 1997/A2: 2001 Low Voltage Directive (73/23/EEC) EN61010-1: 2001
	FCC Rule	FCC Part15
External dimensions	48 (W) mm x 96 (H) mm x 115 (D) mm Case depth: approx. 105 mm (when panel-mounted)	
Mass	Approx. 400 g	
Compatible sensors	ESD, ESL, and FS-series conductivity sensor; cell constant: 0.01/cm, 0.1/cm, or 1.0/cm	

2 Installation

2.1 Installation environment

To keep the instrument stable and reliable for use, install it in a place where the following conditions are satisfied.

Instrument body

- Well-ventilated
- Ambient temperature is in the range of -5°C to 45°C
- Where the air is not hot
- Not exposed to direct sunlight
- Not exposed to direct radiant heat
- Ambient relative humidity is in the range of 20% to 85%
- The instrument is not splashed with water or chemicals
- Mechanical vibration is rare
- There is enough space for maintenance and wiring
- Dust and corrosive gases are not present
- The influence of electromagnetic fields is rare
- A place whose altitude is less than 2000 m
- The range of power supply voltage fluctuation is within 10% of the rated voltage
- A place where Overvoltage Category II is satisfied (This regulation is applied to the electrical machinery that is powered by stationary equipment such as a switchboard.)

Sensor

- Sensors can be checked and maintained
- No bubbles appear in the measuring solution
- Measuring solution does not corrode the wetted part of the sensor.

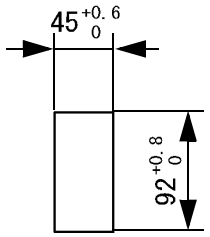
Note

For the details, refer to the instruction manual provided with the sensor.

2.2 Installation procedure

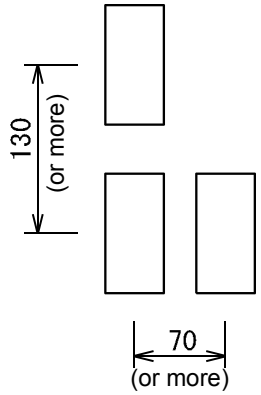
Mount the instrument on a control panel.
The panel thickness should be 1.0 mm to 9.0 mm.

Cut a square with dimensions shown in the figure below from the control panel.



[Unit: mm]

When installing the instruments in a row, leave an interval of 70 mm or more horizontally and 130 mm or more vertically between the square openings.

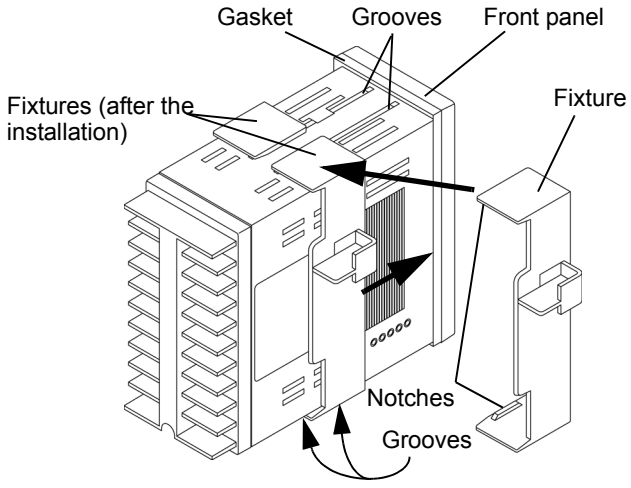


[Unit: mm]

● Mounting

Insert the instrument into the square opening and secure it with fixtures.

1. **Insert the instrument body from into the opening the front of the control panel.**
2. **Attach one of the two fixtures on the instrument, fitting its notches into the grooves located on the top and bottom of the body case.**
3. **Attach the other fixture, in the same way.**
4. **Slide the both fixtures to the front panel to secure the instrument body.**

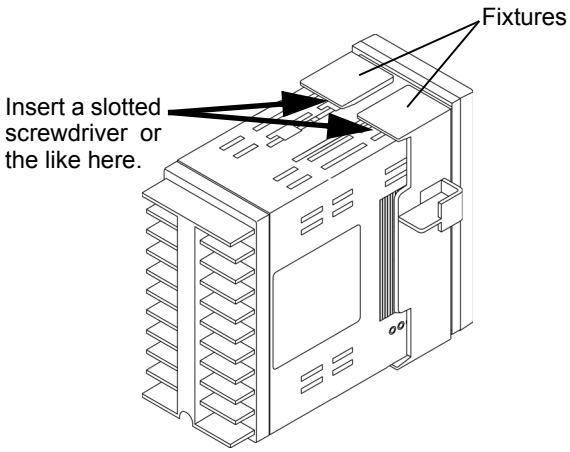


Note

The gasket is a consumable. Replace it with a new one when its holding power has become weak.

Dismounting

1. **Remove the cables from the terminal block.**
   Remove the fixtures one by one, and then the instrument body from the panel.
2. **Insert a slotted screwdriver or the like into the gap between a fixture and the instrument body to detach a notch from the groove.**
3. **Remove the fixture.**
4. **Remove the other fixture, in the same way.**
5. **Pull out the instrument body from the control panel.**



2.3 Connection

2.3.1 Connecting the contact outputs

- The contact capacity is 240 V AC 3 A or less, or 30 V DC 3 A or less.
- If load noise is observed, use a varistor or noise killer.

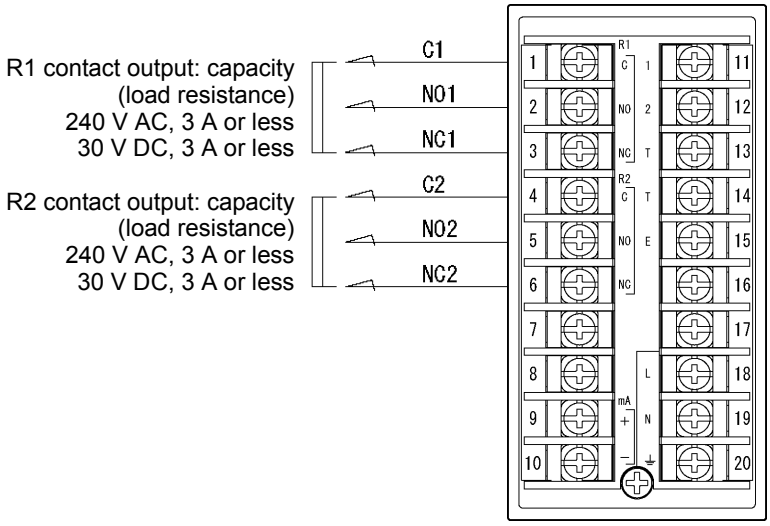
Mandatory

To connect a load beyond the contact capacity or use inductive load (such as a motor, or pump), be sure to use a power relay whose rating is higher than the load.

Caution

When the instrument is turned off, the C-NC contact is shorted. Be careful when connecting a load.

Make output connections as shown in the figure shown below.



2.3.2 Connecting the sensor cable

Precautions for handling the sensor cable

The conductivity sensor cable is highly insulated. Follow the instructions below when handling it.

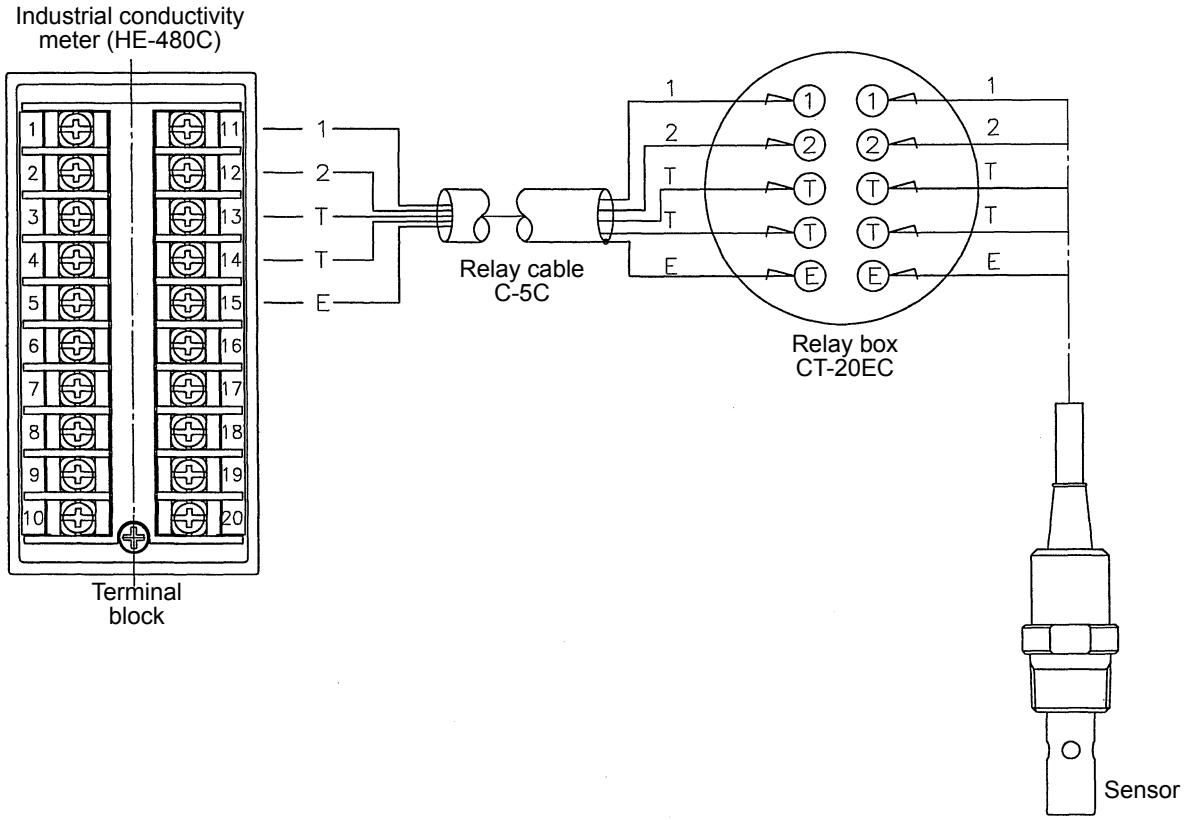
- Do not wet the terminals of the cable or the terminal block, nor stain them with finger marks or oil. Otherwise, the insulation of the cable is weakened.
  If the insulation is weakened, the readout may become unstable. Keep the cable dry and clean all the time.
  If a terminal is stained, wipe the dirt off using alcohol or the like and dry the terminal well.
- Allow enough cable length for calibration, or inspection/replacement of the sensor.
- Wire the sensor cable and junction cables keeping them off any devices that may give inductive interferences such as a motor or its cables.

Connection

The sensor cable has the following terminals.

1	:	Conductivity sensor terminal (1)
2	:	Conductivity sensor terminal (2)
T, T	:	Temperature compensation sensor terminal
E	:	Shielded wire

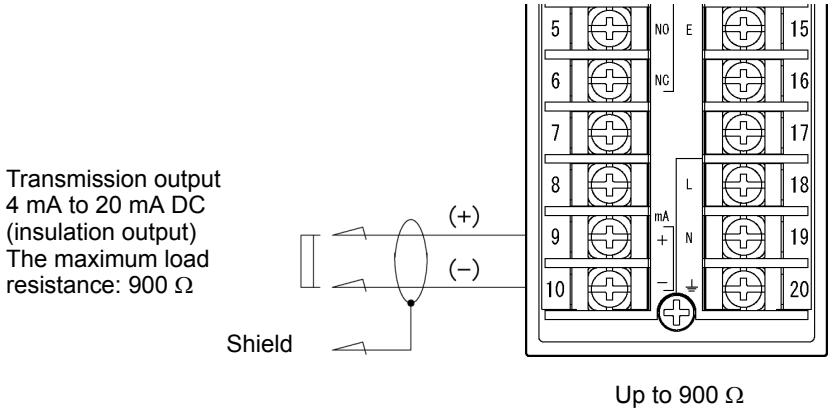
Connect the cable to the terminal block as shown in the figure below. Making sure that each terminal of the cable is connected to the counterpart of the block correctly.



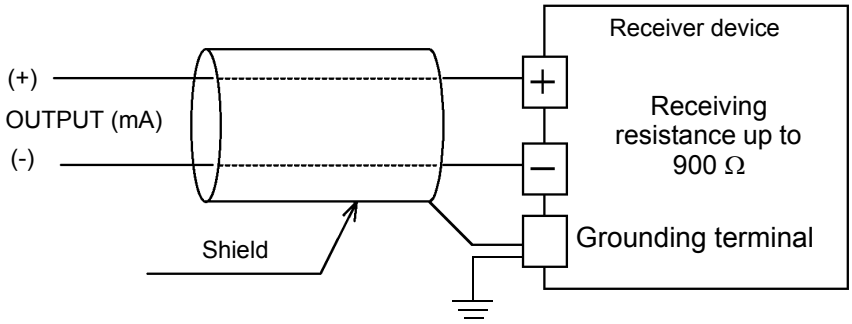
2.3.3 Connecting the transmission output cable

A signal of 4 mA to 20 mA DC corresponding to the measurement range is output.
The maximum allowable input resistance of the receiver device is 900 Ω.
Select an appropriate receiver device (recorder or meter relay).

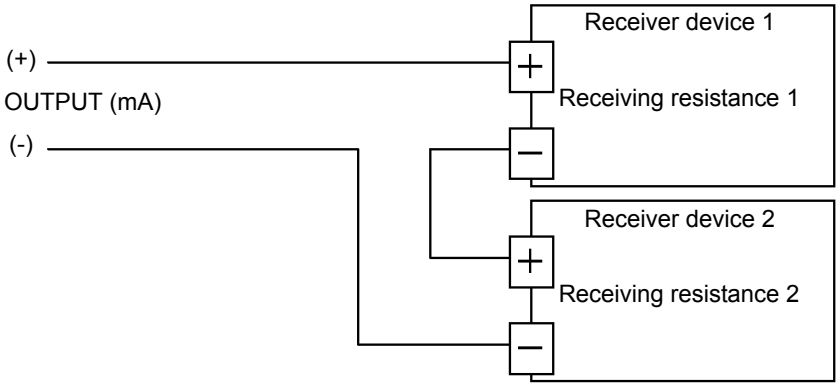
1. **Connect the cable to the terminal block referring to the figure below.**
Use a shielded wire for the transmission cable.



2. **Ground the shielded line via the grounding terminal of the receiver device side.**



● **When two or more receiver devices are connected.**
Connect them in a series as shown in the figure below.
The allowable total resistance of the connected receiver devices is max 900 Ω.



Mandatory

Install lightning arresters both at the instrument and receiver device.

2.3.4 Connecting the power supply

Warning

Electric Shock

Make sure that no electric power is supplied to the instrument before starting this work.
Do not turn on the power until your work is completed.

About the power switch

This instrument has no power switch. Install a power switch or circuit breaker around to turn ON/OFF the instrument.

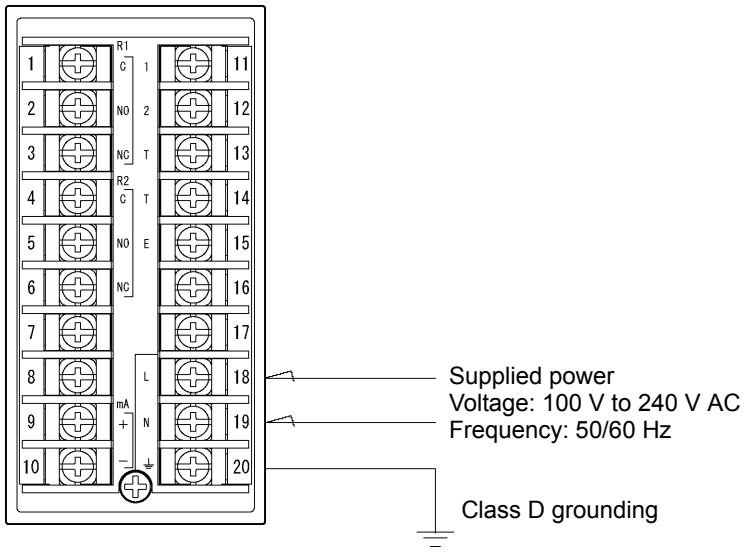
Connecting the power cable

The power supply of this instrument is a variable power supply that the rated voltage is 100 V to 240 V AC, 50/60 Hz.
The maximum power is 10 VA.

Caution

Operating the instrument using a voltage out of the rated range may cause it to malfunction. Be sure to check the voltage of the power supply. Also make sure that the fluctuation of the power supply voltage is within the range of 10% of the rated voltage.

Connect and ground the power cable referring to the figure below.



About the grounding

Mandatory

Be sure to ground the earth terminal (class D grounding) for safety.

The grounding for the instrument should be separated from that of electrical devices such as a motor.

2.3.5 Attaching the terminal covers

Be sure to attach the terminal cover after wiring to the terminal block is completed.

3 Preparation

When you start using the instrument for the first time after factory shipment or resetting it to factory settings, be sure to complete the following preparation procedures.

- Wiring checking
- Initial set up
- Calibration

● Wiring checking

Check the following.

- Are the power cable, sensor cable, and transmission cable properly wired?
- Are the terminal block screws firmly tightened?
- Is the fluctuation of the power supply voltage within ±10% of the rated voltage?

● Initial set up

When the instrument is powered on in the factory setting state, it starts up in the Maintenance mode.

Check the current settings referring to Table 1.

If necessary, change settings following the instructions in “4.2 Basic settings” (page 19).

To finish the initial setup, press the MEAS key repeatedly until the MEAS lamp lights up to go to the measurement mode.

Once the initial setup is finished, the instrument starts up in the measurement mode since then. This is the normal measurement mode.

Table 1 Basic setup items

Display	Description	Options	Factory setting
SEnS	Sensor settings		
CELL	Selection of the cell constant of the sensor being used.	0.01, 0.1, 1.0 (/cm)	0.01
CoEF	Setting of the compensation coefficient for the cell constant	0.001 to 5.000	1.000
t_Co	Setting of the RTD temperature coefficient	3500 to 4000 (ppm/°C)	3750
rESt	Setting of the RTD resistance compensation (Ω)	±5.00 (Ω)	0.00
CAbL	Cable length compensation	0 to 100 (m)	10
Para	Parameters for measurement		
Unit	Unit selection	Conv (μS/cm), SI (mS/m), tdS (mg/L)	Conv
rnG	Measurement range setting	Available options vary depending on the settings of cell constant “CELL” and unit “Unit”.	20.00
tC	Selection of calculation method of temperature compensation	PurE, nACl, t.CoE, oFF	nACl
t.CoE	Temperature coefficient setting	±5.00 (%/°C)	2.00

Display	Description	Options	Factory setting
trEF	Reference temperature setting	5 to 95 (°C)	25
tdS	Setting of TDS conversion coefficient	When “tdS” has been set for the unit selection: 0.30 to 1.00	0.50
dFct	Setting of the number of moving average times (dumping factor)	1 to 20 (times)	1
diSP	Display settings		
S.dSP	Setting of items to be displayed on the sub-display	no, 1.SEt, 2.SEt, t	t
r.cut	Measurement range cut Does not display values out of the conductivity range specified in “Measurement range setting”.	YES, no	YES
t.drG	Decimal place for temperature values	1, 0.1, 0.01	0.1
r 1	Relay output 1 settings		
1.SEL	Selection of the target for relay output 1	non, Cond, Hold, Err, FAiL, USP	Cond
1.USP	Safety factor of USP criterial value for relay output 1	30 to 100 (%)	100
1. rE	Reverse output for relay 1	YES, no	no
1.H-L	Selection of upper or lower limit for relay 1	H, L	H
1.SEt	Control value setting for relay 1	The setting range is 0.00 to the conductivity value specified in the measurement range setting	20.00
1.dFS	Selection of control width type for relay 1	d.diF, S.diF	d.diF
1.d iF	Setting value for control width in both directions	0% to 20% of the measurement range	4.00
1.udF	Setting value for control width in one direction, width before the control value	0% to 10% of the measurement range	2.00
1.odF	Setting value for control width in one direction, width after the control value	0% to 10% of the measurement range	2.00
1.ond	Duration of alarm output, starting from alarm output to the time when the contact output (between C and NO) is turned ON (unit: seconds)	0 to 600 (seconds)	0
1.oFd	Duration of alarm clear, starting from alarm clear to the time when the contact output (between C and NO) is turned OFF (unit: seconds)	0 to 600 (seconds)	0
r2	Relay output 2 settings		
2.SEL	Selection of the target for relay output 2	non, Cond, Hold, Err, FAiL, USP	Cond

Display	Description	Options	Factory setting
2USP	Safety factor of USP criterial value for relay output 2	30 to 100 (%)	100
2. rE	Reverse output for relay 2	YES, no	no
2H-L	Selection of upper or lower limit for relay 2	H, L	L
2SEt	Control value setting for relay 2	The setting range is 0 to the conductivity value specified in the measurement range setting	0.00
2dFS	Selection of control width type for relay 2	d.diF, S.diF	d.diF
2d iF	Setting value for control width in both directions	0% to 20% of the measurement range	4.00
2udF	Setting value for control width in one direction, width before the control value	0% to 10% of the measurement range	2.00
2odF	Setting value for control width in one direction, width after the control value	0% to 10% of the measurement range	2.00
2ond	Duration of alarm output, starting from alarm output to the time when the contact output (between C and NO) is turned ON (unit: seconds)	0 to 600 (seconds)	0
2oFd	Duration of alarm clear, starting from alarm clear to the time when the contact output (between C and NO) is turned OFF (unit: seconds)	0 to 600 (seconds)	0
Cur	Transmission output setting		
rn0.0	Cond value for zero point (4 mA) of the transmission output range	Available options vary depending on the settings of cell constant “CELL” and unit “Unit”.	0.00
rn0.5	Cond value for span point (20 mA) of the transmission output range	Available options vary depending on the settings of cell constant “CELL” and unit “Unit”.	20.00
Hold	Holds the previous value of transmission output during calibration mode (except for maintenance mode)	YES, PrES, no	YES
PrES	Setting value for preset (arbitrary value) hold	Available options vary depending on the settings of cell constant “CELL” and unit “Unit”.	20.00
C.cut	Transmission output cut Does not output values out of the range of 4 to 20 mA	YES, no	YES

4 Measurement

4.1 Measurement

Power on the conductivity meter with the preparation (see page 16) is completed, and the instrument meter will start up in the measurement mode.

1. **Turn the power on.**
The measurement target appears on the measurement display.
The measurement range is then displayed and the instrument enters the measurement mode.
After the measurement value is displayed, and the measurement starts.
This is the normal measurement mode.

4.2 Basic settings

Enter the maintenance mode to set up the sensor, measurement conditions, display settings, calibration method, contact output and transmission output.

● Precautions

- Previous value hold is used for transmission output.
- Contact outputs are the following status:
  - OFF when the control target is set to non, Cond or Err.
  - ON when the control target is set to Hold, ON
  - FAIL when the control target is set to FAiL and a system error occurs.

● How to open basic setup menus

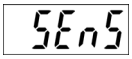
1. **Hold down the MNT key in the measurement mode until the MNT lamp lights up.**
The maintenance mode is enabled, and “SEt” is shown on the measurement display.

2. **Press the ENT key.**
The basic setup menu is enabled, and “SEnS” is shown on the sub-display.

3. **Press the UP/DOWN key to display the item to be set up on the sub-display.**

4. **Press the ENT key.**
The display shows the setup screen, ready for selection of setting items.
The displays shown on the sub-display and setting items are shown in the table below.

Table 2 Displays shown on the sub-display and setting items

Display	Basic setup item	Description	Reference	Remarks
	Sensor setting	Cell constant selection	page 21	
		Cell constant compensation coefficient setting	page 22	
		RTD temperature coefficient setting	page 22	
		RTD resistance compensation setting	page 23	
		Cable length compensation	page 23	

Display	Basic setup item	Description	Reference	Remarks
PArA	Measurement conditions	Unit selection	page 24	
		Measurement range setting	page 24	
		Selection of calculation method of temperature compensation	page 25	
		Temperature coefficient setting	page 26	Available only when “t.CoE” has been selected for calculation method of temperature compensation.
		Reference temperature setting	page 27	Available only when “PUrE”, “nACl”, or “t.CoE” has been selected for calculation method of temperature compensation.
		TDS conversion coefficient setting	page 27	Available only when “tdS” has been selected for unit selection.
		Number of moving average times (dumping factor)	page 28	
diSP	Display setting	Sub-display setting	page 29	
		Display outside the measurement range	page 29	
		Decimal place selection	page 30	
r1 r2	Relay output: R1/ R2	Control target selection	page 33	*
		Safety factor for USP criterial value	page 33	
		Reverse control output	page 35	
		Control method	page 36	
		Control value	page 36	
		Control width type	page 37	
		Control width	page 38	
		Delay time (for relay ON)	page 39	
		Delay time (for relay OFF)	page 39	
tur	Transmission output	Transmission output	page 40	

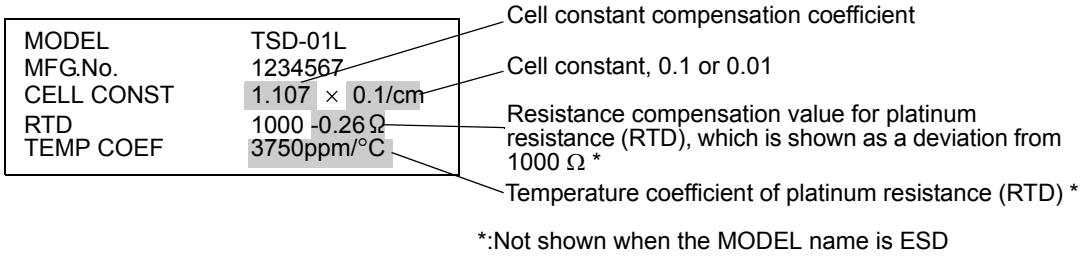
*: For the options available for the selected control target, refer to “● Control targets and their available options” (page 32).

Tip

Press the MEAS key to return to the menu one tier up.
To return to the basic setup menu from the setup screen, press the MEAS key repeatedly until “SEt” is shown on the measurement display and nothing is shown on the sub-display, and then press the ENT key.

4.2.1 Sensor setting

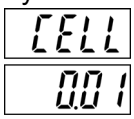
Enter the values found on the sensor label except the cable length.
Label example:


MODEL TSD-01L
MFG.No. 1234567
CELL CONST 1.107 × 0.1/cm
RTD 1000 -0.26Ω
TEMP COEF 3750ppm/°C
Cell constant compensation coefficient
Cell constant, 0.1 or 0.01
Resistance compensation value for platinum resistance (RTD), which is shown as a deviation from 1000 Ω *
Temperature coefficient of platinum resistance (RTD) *

*:Not shown when the MODEL name is ESD

● **Cell constant selection**

1. **Open the sensor setting menu referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for cell constant setting, "CELL".

   ← Current setting
2. **Press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Select the cell constant from 0.01, 0.1, and 1.0 using the UP/DOWN key.**
4. **Press the ENT key to establish the setting.**

Note

The cell constant of the sensor is found on the lead wire at the end to be connected to the main unit. Be sure to set this value to the main unit.

Tip

- **To set another item in the sensor setting next, press the DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● Cell constant compensation coefficient setting

1. **Open the sensor setting menu referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for cell constant setting, "CELL".
2. **Display "CoEF" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the cell constant compensation coefficient.**
   UP key : Increments the value by 0.001.
   DOWN key : Decrements the value by 0.001.
   The setting range is 0.001 to 5.000.
4. **Press the ENT key to establish the setting.**

Tip

- **To set another item in the sensor setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● RTD temperature coefficient setting

1. **Open the sensor setting menu referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for cell constant setting, "CELL".
2. **Display "t_Co" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the RTD temperature coefficient.**
   UP key : Increments the value by 1 ppm/°C.
   DOWN key : Decrements the value by 1 ppm/°C.
   The setting range is 3500 to 4000 ppm/°C.
4. **Press the ENT key to establish the setting.**

Note

Do not change the default value (3750 ppm) when no temperature coefficient (TEMP COEF) is specified for platinum resistance (RTD).

Tip

- **To set another item in the sensor setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● RTD resistance compensation setting

1. **Open the sensor setting menu referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for cell constant setting, "CELL".
2. **Display "rESt" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the RTD resistance compensation value.**
   UP key : Increments the value by 0.01 Ω.
   DOWN key : Decrements the value by 0.01 Ω.
   The setting range is -5.00 Ω to 5.00 Ω.
4. **Press the ENT key to establish the setting.**

Note

- **The compensation value for platinum resistance (RTD) at 0°C is found on the label only for certified sensors such as TRD series sensors. As for conventional sensors and uncertified sensors, no resistance compensation value (deviation) is found on the label. In this case, set the resistance value to 0 Ω.**
- **The resistance value of cable is not taken into consideration of the compensation value for platinum resistance at 0°C.**

Tip

- **To set another item in the sensor setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● Cable length compensation

Set the length of the cable.
The line resistance becomes a cause of temperature measurement errors when the sensor cable length is not the standard one (10 m). This functionality is used to compensate for it.

1. **Open the sensor setting menu referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for cell constant setting, "CELL".
2. **Display "CAbL" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the RTD resistance compensation value.**
   UP key : Increments the value by 1 m.
   DOWN key : Decrements the value by 1 m.
   The setting range is 0 m to 100 m.
4. **Press the ENT key to establish the setting.**

Tip

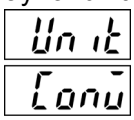
- **When the length of the sensor cable is not 10 m, which is the standard length for the instrument, specify the length of the cable used in the main unit (unit: m). By doing so, errors in measured temperatures are compensated before being displayed.**
- **To set another item in the sensor setting next, press the UP key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

4.2.2 Measurement condition

● Unit selection

Select the unit for measurement values.

1. **Open the measurement condition setting screen referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for unit setting, "Unit".

   ← Current setting
2. **Press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Select a unit using the UP/DOWN key.**
   Conv (Conventional) : μS/cm
   SI : mS/m
   tdS (Total Dissolved Solids) : mg/L
4. **Press the ENT key to establish the setting.**

Tip

- **To set another item in the measurement condition setting next, press the DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● Measurement range setting

Set the maximum value of the measurement range. the measurement range will be 0 to the value specified here.

1. **Open the measurement condition setting screen referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for unit setting, "Unit".
2. **Display "rnG" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the upper limit of the range.**
   For the available options, refer to the table shown below:

Unit "Unit"	Cell constant "CELL"					
	0.01		0.1		1.0	
Conv (μS/cm)	2.000	20.00	20.00	200.0	200.0	2000
SI (mS/m)	0.2000	2.000	2.000	20.00	20.00	200.0
tdS (mg/L)	2.00	20.0	20.0	200	200	2000

4. **Press the ENT key to establish the setting.**

Tip

- **To set another item in the measurement condition setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● Selection of calculation method for temperature compensation

Select the calculation method for temperature compensation.

1. **Open the measurement condition setting screen referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for unit setting, "Unit".
2. **Display "tC" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the calculation method for temperature compensation.**
   - PurE : Temperature compensation based on the temperature characteristics of deionized water
   - nACl : Temperature compensation based on the temperature characteristics of NaCl
   - t.CoE : Temperature compensation based on the temperature coefficient for conductivity (%/°C) and used-defined reference temperature
   - oFF : No temperature compensation
4. **Press the ENT key to establish the setting.**

Tip

- **In the "PurE" mode, you can change the reference temperature to a value other than 25°C.**
- **In the "nACl" mode, you can change the reference temperature to a value other than 25°C.**
- **In the "t.CoE" mode, you can set the temperature coefficient in the range of -5%/°C to 5%/°C and reference temperature in the range of 5°C to 95°C.**
- **In the "oFF" mode, no "out of the temperature compensation error" arises.**
- **To set another item in the measurement condition setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● Calculation method for temperature compensation and available options

Make the setting referring to the table below.
The displayed options vary depending on the setting of the calculation method for temperature compensation.
Items with a check mark are available for selection.

	Reference temperature	Temperature coefficient
PurE	✓	—
nACl	✓	—
t.CoE	✓	✓
oFF	—	—

● Temperature coefficient setting

Set the temperature coefficient.

A temperature coefficient is the value that shows the percentage of change in conductivity for 1°C of change in temperature.

1. **Open the measurement condition setting screen referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for unit setting, "Unit".
2. **Display "t.CoE" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the temperature coefficient.**
   UP key : Increments the value by 0.01%/°C.
   DOWN key : Decrements the value by 0.01%/°C.
   The setting range is -5.00%/°C to 5.00%/°C.
4. **Press the ENT key to establish the setting.**

Note

When the temperature coefficient is set to 0%/°C, conductivity is displayed without temperature compensation. In this state, the reference temperature has no meaning.

Tip

- **When errors arise in using the temperature characteristics of deionized water, set a value close to the temperature coefficient of the sample for more accurate measurements.**
- **To set another item in the measurement condition setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● Reference temperature setting

Set the reference temperature.

A reference temperature is the base temperature used when determining a temperature coefficient. It is also referenced for conversion in temperature compensation calculation.

1. **Open the measurement condition setting screen referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for unit setting, "Unit".
2. **Display "trEF" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the reference temperature.**
   UP key : Increments the value by 1°C.
   DOWN key : Decrements the value by 1°C.
   The setting range is 5°C to 95°C.
4. **Press the ENT key to establish the setting.**

Note

- **Under normal conditions, the instrument operates using the reference temperature of 25°C.**
- **This functionality may produce a large margin of error when conductivity does not change linear to temperature change or the sample temperature is greatly different from the reference temperature.**

Tip

- **To set another item in the measurement condition setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● TDS conversion coefficient setting

Set the TDS conversion coefficient.

TDS is given by multiplying conductivity by a TDS conversion coefficient, which is based on the conversion in KCl or $CaCO_3$ solution.

1. **Open the measurement condition setting screen referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for unit setting, "Unit".
2. **Display "tdS" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the TDS conversion coefficient.**
   UP key : Increments the value by 0.01.
   DOWN key : Decrements the value by 0.01.
   The setting range is 0.30 to 1.00.
4. **Press the ENT key to establish the setting.**

Tip

- **To set another item in the measurement condition setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● What is TDS?

The term TDS is an acronym for “Total Dissolved Solids”, representing the total amount of solids dissolved in a solution.

The conductivity of a solution is determined based on the amount of salinity, minerals, and dissolved gasses in it. In this respect, conductivity is the indicator of total amount of all substances in the solution. TDS indicates only the amount of dissolved solids in the solution among others.

Although you can obtain accurate results using TDS for comparing materials made up of a single component such as NaCl, errors greatly vary when comparing different kinds of solutions.

The relationship between conductivity and TDS is shown in the equation below:

Conductivity in SI unit (mS/m)	TDS (mg/L) = L (mS/m) × K × 10
Conductivity in conventional unit (μS/m)	TDS (mg/L) = L (μS/cm) × K

K = TDS conversion coefficient
L = Conductivity

● Number of moving averages (dumping factor)

Set the number of moving averages for measurements to be displayed.

1. **Open the measurement condition setting screen referring to “● How to open basic setup menus” (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for unit setting, “Unit”.
2. **Display “dFct” on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the TDS conversion coefficient.**
   UP key : Increments the value by 1.
   DOWN key : Decrements the value by 1.
   The setting range is 1 time to 20 times.
4. **Press the ENT key to establish the setting.**

Tip

- **To set another item in the measurement condition setting next, press the UP key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

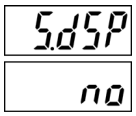
4.2.3 Display method

● **Sub-display setting**

Select the item to be displayed on the sub-display during measurement.

1. **Open the basic setup menu and press the UP/DOWN keys to display the current sub-display setting (as below) on the panel, referring to "● How to open basic setup menus" (page 19).**

The setup item selection screen is displayed on the measurement display, showing the display for sub-display setting, "S.dSP".



← Current setting

2. **Press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**

no :Nothing is displayed.
1.Set :Control value of relay 1
2.Set :Control value of relay 2
t :Temperature

4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item in the display setting next, press the DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● **Measurement range cut ON/OFF**

Specify whether values outside the measurement range, are displayed or not.

1. **Open the basic setup menu and press the UP/DOWN keys to display the current sub-display setting on the panel, referring to "● How to open basic setup menus" (page 19).**

The setup item selection screen is displayed on the measurement display, showing the display for sub-display setting, "S.dSP".

2. **Press the DOWN key to display "r.cut" on the measurement display, and press the ENT key.**

The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to select a setting.**

UP key : YES : Values outside the measurement range are not displayed.
DOWN key : no : Values outside the measurement range are displayed.

4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item in the display setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

● Decimal place selection

Select the decimal place (displayed digits) for displaying temperatures.

1. **Open the basic setup menu and press the UP/DOWN keys to display the current sub-display setting on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for sub-display setting, "S.dSP".
2. **Display "t.drG" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Select the decimal place from 1, 0.1, and 0.01 using the UP/DOWN key.**
4. **Press the ENT key to establish the setting.**

Tip

- **To set another item in the display setting next, press the UP key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

4.2.4 Contact output

Set control actions for R1 and R2 respectively.

This section explains the setup procedures using R1 as an example. Set up the R2 actions in the same way.

The following control items can be set:

Table 3 Contact output: the setting items for R1

Display	Item	Description	Reference	Remarks
1.SEL	Control target	Select the control target from: Measured value, Error, FAIL, During maintenance, No target, USP conductivity assessment	page 33	
1.USP	Safety factor setting for USP value	Set a safety factor (%) when you want to set a more strict criterion than the USP criterial value.	page 33	*
1.rE	Reverse output	Select the reverse output setting, whether the output is reversed or not	page 35	
1.H-L	Control method	Select the limit operation, upper or lower	page 36	
1.SEt	Control value	Set the control value, used as the criterion for switching the relay output ON/OFF.	page 36	
1.dF5	Control width type	● d.diF: Sets the same width is set both over and under the control value at the center. ● S.diF: Different widths are set over and under the control value.	page 37	
1.d iF Or 1.udF 1.odF	Set control width	Set the control widths: ● When the control width type is “d.diF”. Set the width (1.diF) from the control value at the center. ● When the control width type is “S.diF”. The width under the control value (1.udF) and the width over the control value (1.odF).	page 38	
1.ond	Delay time (Relay ON)	Set the alarm output duration from the start until the C-NO contact output turns ON (unit: seconds)	page 39	
1.oFd	Delay time (Relay OFF)	Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF (unit: seconds)	page 39	

*: For the options available for the selected control target, refer to “● Control targets and their available options” (page 32).

Control targets and their available options

Make the setting referring to the table shown below.
Displayed options vary depending on the settings shown in gray.
Items with a check mark are available for selection.

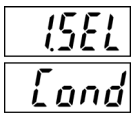
Table 4 Control targets and their available options

Display	Item	Options						
1.SEL	Control target selection	non	Cond		Hold	Err	FAiL	USP
1.USP	Safety factor for USP criterial value							✓
1.rE	Reverse control output		✓		✓	✓	✓	✓
1.H-L	Control method		✓					
1.SEt	Control value		✓					
1.dFS	Control width type		d.diF	S.diF				
1.d iF	Control		✓					
1.udF				✓				
1.odF				✓				
1.ond	Delay time (for relay ON)		✓	✓	✓	✓	✓	✓
1.oFd	Delay time (for relay OFF)		✓	✓	✓	✓	✓	✓

● Control target selection

Select the control target of the contact output.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 (as below) on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".

   ← Current setting
2. **Press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to select a setting.**
   non : No target
   Cond : Measured value
   Hold : During maintenance
   Err : Error
   FAiL : FAIL
   USP : USP conductivity assessment
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Safety factor setting for USP criterial value

The safety factor (%) setting is provided to allow you to set a tighter criterion than USP criterial value.

1. **Open the relay output R1 setting screen referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".
2. **Display "1.USP" on the measurement display using the DOWN key, and press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the safety factor.**
   UP key : Increments the value by 1%.
   DOWN key : Decrements the value by 1%.
   The setting range is 30% to 100%.
4. **Press the ENT key to establish the setting.**

Tip

- **To set another item in the relay output R1 setting next, press the UP/DOWN key to display it.**
- **To return to the basic setup menu, press the MEAS key.**

What is the USP criterial value?

The USP criterial value is the upper limit of conductivity without temperature compensation specified for each of the predefined temperature ranges from 0°C to 100°C. The USP criterial values are used for monitoring conductivity of pharmaceutical-grade water.

The USP 23 (United States Pharmacopoeia 23 Standards) requires pharmaceutical-grade waters to have conductivity less than the values shown in Table 5, “Requirements on temperature and conductivity, Stage 1”.

This instrument has the USP 23 criteria table in it to determine the upper limit of conductivity automatically based on the measured temperature before compensation is made.

Ex.)

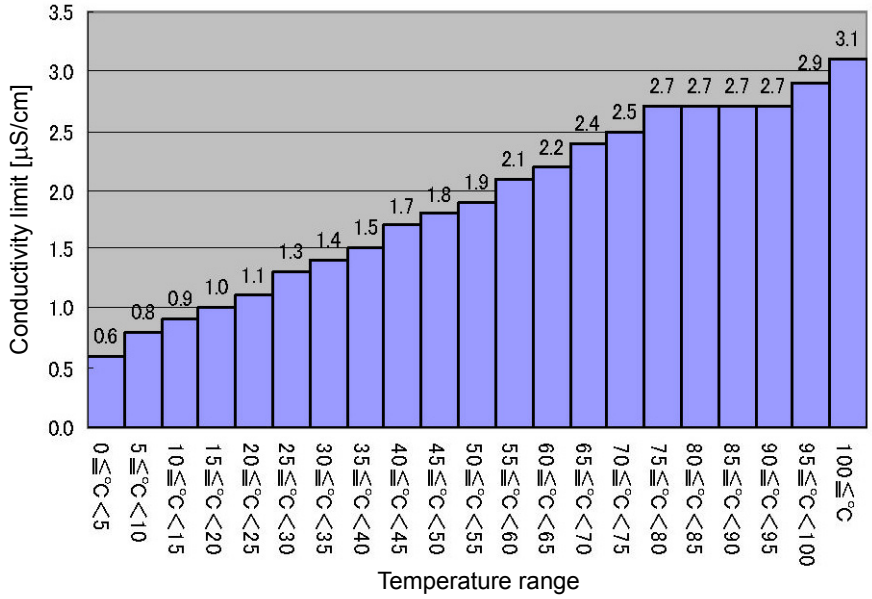
The limit of conductivity for 15°C is 1.0 μS/cm in the table shown below. If you have set the safety factor to 50%, an alarm is issued when the conductivity is detected to be 0.5 μS/cm or more at 15°C.

Table 5 Requirements on temperature and conductivity, Stage 1

Temperature range (°C)	Conductivity limit (μS/cm)
0 ≦ °C < 5	0.6
5 ≦ °C < 10	0.8
10 ≦ °C < 15	0.9
15 ≦ °C < 20	1.0
20 ≦ °C < 25	1.1
25 ≦ °C < 30	1.3
30 ≦ °C < 35	1.4
35 ≦ °C < 40	1.5
40 ≦ °C < 45	1.7
45 ≦ °C < 50	1.8

Temperature range (°C)	Conductivity limit (μS/cm)
50 ≦ °C < 55	1.9
55 ≦ °C < 60	2.1
60 ≦ °C < 65	2.2
65 ≦ °C < 70	2.4
70 ≦ °C < 75	2.5
75 ≦ °C < 80	2.7
80 ≦ °C < 85	2.7
85 ≦ °C < 90	2.7
90 ≦ °C < 95	2.7
95 ≦ °C < 100	2.9
100°C or more	3.1

USP 23 conductivity requirements



● Reverse output setting

Select whether or not to invert the control output of the control target.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".
2. **Press the DOWN key to display "1.rE" on the measurement display, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to select a setting.**
   UP key : YES : The control output is reversed.
   DOWN key : no : The control output is not reversed.
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● How to output FAIL during power OFF.

To output FAIL while the power supply is turned off, make the following three setting.

- Connect a cable between C and NC.
- Set the control target (1.SEL) to FAiL.
- Set the reverse output (1.rE) YES.

Note

When this function is enable, the target of the delay time setting is also reversed. To delay the FAIL output, use the delay time setting for relay OFF.

Tip

Set the reverse output (1.rE) to no whenever the control target (l.SEL) is set to an item other than FAiL.

● Control method setting

Select the limit operation, upper or lower

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".
2. **Press the DOWN key to display "1.H-L" on the measurement display, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to select a setting.**
   UP key : H : Upper limit operation
   DOWN key : L : Lower limit operation
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Control value setting

Set the control value, used as the criterion for switching the relay output ON/OFF.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".
2. **Press the DOWN key to display "1.SEt" on the measurement display, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set a setting.**
   UP key : Increments the value by the minimum display unit.
   DOWN key : Decrements the value by the minimum display unit.
   The setting range is the measurement range.
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Control width type setting

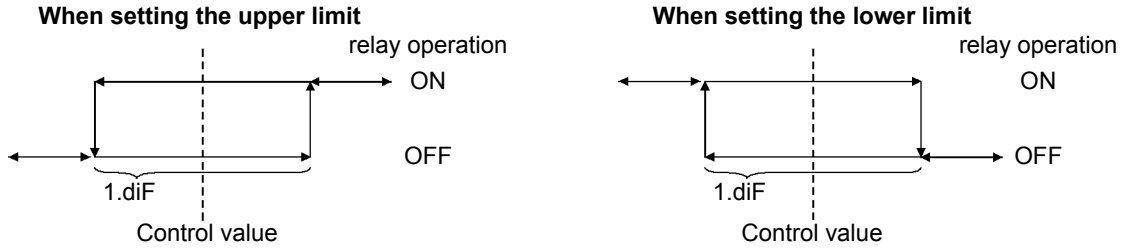
Select the control width type.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".
2. **Press the UP/DOWN key to display "1.dFS", and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to select a setting.**
   UP key : d.diF : Sets the same width is set both over and under the control value at the center.
   DOWN key : S.diF : Different widths are set over and under the control value.
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Example of d.diF setting



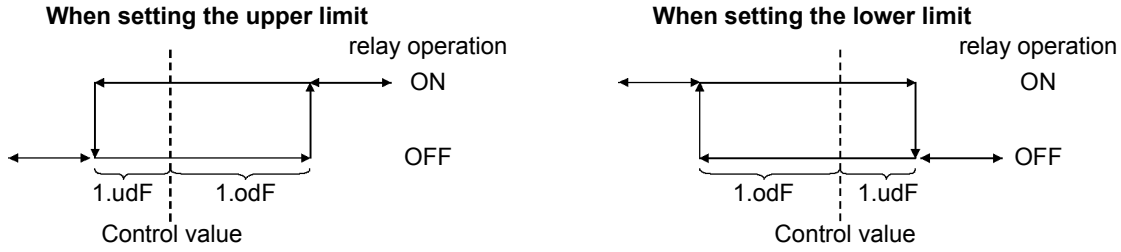
When setting the upper limit

When the control value has been set to 15.00 μS/cm and 1.dif to 1.00 μS/cm, the relay turns ON at 15.50 μS/cm and turns OFF at 14.50 μS/cm.

When setting the lower limit

When the control value has been set to 15.00 μS/cm and 1.dif to 1.00 μS/cm, the relay turns ON at 14.50 μS/cm and turns OFF at 15.50 μS/cm.

● Example of S.diF setting



When setting the upper limit

When the control value has been set to 15.00 μS/cm, 1.udf to 1.00 μS/cm, and 1.odf to 2.00 μS/cm, the relay turns ON at 16.00 μS/cm and turns OFF at 13.00 μS/cm.

When setting the lower limit

When the control value has been set to 15.00 μS/cm, 1.udf to 1.00 μS/cm, and 1.odf to 2.00 μS/cm, the relay turns ON at 13.00 μS/cm and turns OFF at 16.00 μS/cm.

● Control width setting

Set the control widths. The procedures are different depending on the selected control width type.

● When the control width type is “d.diF”

Sets the same width is set both over and under the control value at the center.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to “● How to open basic setup menus” (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, “1.SEL”.
2. **Press the UP/DOWN key to display “1.diF”, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to select the control width.**
   UP key : Increments the value by the minimum display unit.
   DOWN key : Decrements the value by the minimum display unit.
   The setting range is 0.00% to 20% of the measurement range.
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● When the control width type is “S.diF”

Different widths are set over and under the control value.

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to “● How to open basic setup menus” (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, “1.SEL”.
2. **Press the UP/DOWN key to display “1.udF”, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the control width for under the control value.**
   UP key : Increments the value by the minimum display unit.
   DOWN key : Decrements the value by the minimum display unit.
   The setting range is 0.00% to 10% of the measurement range.
4. **Press the ENTER key to establish the setting.**
   The display returns to the contact output setting menu.
5. **Press the DOWN key to display “1.odF”, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
6. **Press the UP/DOWN key to select the control width over the control value.**
   UP key : Increments the value by the minimum display unit.
   DOWN key : Decrements the value by the minimum display unit.
   The setting range is 0.00% to 10% of the measurement range.
7. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Delay time setting for relay ON

Set the alarm output duration from the start until the C-NO contact output turns ON (unit: seconds).

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".
2. **Press the UP/DOWN key to display "1.ond" on the measurement display, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the delay time (seconds).**
   UP key : Increments the value by one second.
   DOWN key : Decrements the value by one second.
   The allowable value is 0 seconds to 600 seconds.
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Delay time setting for relay OFF

Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF (unit: seconds).

1. **Open the basic setup menu and press the UP/DOWN keys to display the control target setting for R1 on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for control target setting, "1.SEL".
2. **Press the DOWN key to display "1.oFd" on the measurement display, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the delay time (seconds).**
   UP key : Value increases in the unit for one second.
   DOWN key : Value decreases in the unit for one second.
   The allowable value is 0 seconds to 600 seconds.
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of relay output 1 setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

4.2.5 Transmission output

Set up the items related to transmission output.

Table 6 Settings for transmission output

Display	Item	Description	Reference	Remarks
mA0	Zero point of the transmission output range	Set the measured value corresponding to 4 mA is parallelized	page 40	
mA5	Span point of the transmission output range	Set the measured value corresponding to 20 mA is parallelized	page 41	
Hold	Hold output	Select the hold method	page 41	
PrES	Hold value	Value of the optional hold	page 42	Valid only when the hold output is set to “PrES”,
Lcut	Transmission output limit	Select the transmission output setting, whether values outside the range of 4 mA to 20 mA are output or not	page 42	

● **Zero point of the transmission output range**

Set the measured value corresponding to 4 mA is parallelized

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output (as below) on the panel, referring to “● How to open basic setup menus” (page 19).**

   The setting screen is displayed on the measurement display, showing the display for transmission output range's zero point setting, “mA.0”.

   mA0

   0.000 ← Current setting

2. **Press the ENT key.**

   The sub-display starts blinking. Now you can change the setting.

3. **Press the UP/DOWN key to specify a conductivity value corresponding to the zero point output.**

   UP key : Increments the value by the minimum display unit.

   DOWN key : Decrements the value by the minimum display unit.

   The setting range is the measurement range plus 10% of the measurement range.

   Ex.) In the case of the measurement range 0.00 μS/cm to 20.00 μS/cm

   The setting range of transmission output range zero point: 0.00 μS/cm to 22.00 μS/cm

4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Span point of the transmission output range

Set the measured value corresponding to 20 mA is parallelized

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for transmission output range's zero point setting, "mG.0".
2. **Press the DOWN key to display "rnG.S", and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the Cond value corresponding to the span point output.**
   UP key : Increments the value by the minimum display unit.
   DOWN key : Decrements the value by the minimum display unit.
   The setting range is the measurement range plus 10% of the measurement range.
   Ex.) In the case of the measurement range 0.00 μS/cm to 20.00 μS/cm
   The setting range of transmission output range span point: 0.00 μS/cm to 22.00 μS/cm
4. **Press the ENTER key to establish the setting.**

Note

If the zero point and span point are set to the same value, the actual output is fixed to 20 mA.

Tip

- **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Hold output

Select the hold method when the mode is switched from measurement to calibration.

Tip

When the mode is switched to maintenance, the previous value hold is used as the hold value.

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for transmission output range's zero point setting, "mG.0".
2. **Press the DOWN key to display "Hold", and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to select a setting.**
   YES : The previous value is used as the hold value (Previous value hold).
   PrES : A preset value is used as the hold value (Preset hold).
   no : Hold output is not used (Actual data is output continuously).
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Hold value

Set the hold value to be used if preset hold is enable.

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for transmission output range's zero point setting, "mG.0".
2. **Press the DOWN key to display "PrES" on the measurement display, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to specify a Cond value to output as the hold value.**
   UP key : Increments the value by the minimum display unit.
   DOWN key : Decrements the value by the minimum display unit.
   The setting range is the measurement range plus 10% of the measurement range.
   Ex.) In the case of the measurement range 0.00 μS/cm to 20.00 μS/cm
   The setting range of hold value: 0.00 μS/cm to 22.00 μS/cm
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

● Transmission output limit

Select the transmission output setting, whether values outside the range of 4 mA to 20 mA are output or not.

1. **Open the basic setup menu and press the UP/DOWN keys to display the zero setting of transmission output on the panel, referring to "● How to open basic setup menus" (page 19).**
   The setup item selection screen is displayed on the measurement display, showing the display for transmission output range's zero point setting, "mG.0".
2. **Press the DOWN key to display "C.cut" on the measurement display, and then press the ENT key.**
   The sub-display starts blinking. Now you can change the setting.
3. **Press the UP/DOWN key to set the transmission output limit ON/OFF.**
   UP key: YES:Values under the zero point or over the span point are not output.
   DOWN key:no: Values below the zero point or over the span point are output.
4. **Press the ENTER key to establish the setting.**

Tip

- **To set another item of transmission output setting next, press the UP/DOWN key to display it.**
- **To select another setting item, press the MEAS key.**

4.3 Calibration

Three types of calibration are provided, namely temperature calibration, adjustment of conductivity zero point's compensation coefficient, and adjustment of cell constant compensation coefficient.

Table 7 Calibration setting items

Display	Item	Description	Reference	Remarks
t	Temperature calibration	For temperature calibration; Set the deviation from the sample temperature only.	page 44	
Adj	Adjustment of conductivity zero point's compensation coefficient (Adjust)	Conductivity zero point's compensation coefficient	page 44	Only when instrumental errors exist.
SPAn	Adjustment of cell constant compensation coefficient (Span)	Cell constant compensation coefficient	page 45	Only when instrumental errors exist.

Note

Be sure to perform calibration after the power is turned ON for the first time.

- **Precautions**
  - Previous value hold is used for transmission output during the maintenance mode.
  - Contact outputs are in the following states during the maintenance, depending on the selected control target.
    - OFF when the control target is set to non, Cond or Err.
    - ON when the control target is set to Hold.
    - FAIL when the control target is set to FAiL and a system error occurs.

4.3.1 Temperature calibration

Adjust the temperature compensation value.

● **Operation**

1. **Dip the electrode into a solution of known temperature, and allow time for the temperature sensor to stabilize.**
2. **Hold down the MNT key in the measurement mode until the MNT lamp lights up.**
   The instrument enters the maintenance mode, and “SEt” is shown on the measurement display.
   Measurement stops, and the instrument enter a state of hold.
3. **Press the DOWN key to display “CAL” on the measurement display, and then press the ENT key.**
   The instrument enters the calibration menu, and “t_” is shown on the sub-display.
4. **Press the ENT key.**
   The instrument enters the temperature calibration menu. The sub-display starts blinking.
5. **Press the UP/DOWN key to set the value on the measurement display to the solution temperature.**
   UP key : Increments the value by the minimum display unit.
   DOWN key : Decrements the value by the minimum display unit.
   The allowable value is -10°C to 10°C.
6. **Press the ENT key.**
   The temperature calibration factor is updated.
   The above completes the temperature calibration.

Tip

- **You can directly display the temperature calibration menu from the measurement mode. For how to do it, refer to “5.1 Daily calibration (calibration mode)” (page 53).**
- **To abort the calibration, press the MEAS key and instrument will return to the measurement mode without updating calibration data.**
- **To set another item in the calibration setting next, press the DOWN key to display it.**

4.3.2 Adjustment of compensation coefficient for conductivity zero point (Adjust)

Set the compensation coefficient for the conductivity zero point to adjust the instrument to show 0 when the sensor is not in a solution.

● **Operation**

1. **Hold down the MNT key in the measurement mode until the MNT lamp lights up.**
   The instrument enters the maintenance mode, and “SEt” is shown on the measurement display.
   Measurement stops, and the instrument enter a state of hold.
2. **Press the DOWN key to display “CAL” on the measurement display, and then press the ENT key.**
   The instrument enters the calibration menu and “t_” is displayed on the sub-display.
3. **Press the DOWN key to display “Adj” on the sub-display, and then press the ENT key.**
   The instrument enters the menu for adjusting the compensation coefficient for conductivity zero point. The sub-display starts blinking.
4. **Press the UP/DOWN key to set the compensation coefficient for the conductivity zero point.**
   The setting range is ±10% of the value specified in “● Measurement range setting” (page 24).

5. **Press the ENT key.**
The compensation coefficient is updated. Now the adjustment for the compensation coefficient of conductivity zero point has completed.

Tip

- **To abort the calibration, press the MEAS key. The instrument will return to the calibration menu without changing calibration data.**
- **To set another item in the calibration setting next, press the UP/DOWN key to display it.**

4.3.3 Adjustment of compensation coefficient for cell constant (Span)

Set the compensation coefficient to match the measured value with the reference conductivity meter.

Note

- **You need not adjust the cell constant compensation coefficient when the sensor setting has been completed. However, the cell constant may change because of degradation of the sensor and other reasons. You need to adjust the cell constant compensation coefficient only in such occasions.**
- **Calibrations and sensor settings are made independently. Therefore, the calibration does not affect the sensor settings. If you want to return the instrument to the original state, set the compensation coefficient to 1.000.**

● **Operation**

1. **Hold down the MNT key in the measurement mode until the MNT lamp lights up.**
The instrument enters the maintenance mode, and “SEt” is shown on the measurement display.
Measurement stops, and the instrument enter a state of hold.

2. **Press the DOWN key to display “CAL” on the measurement display, and then press the ENT key.**
The instrument enters the calibration menu and “t_” is displayed on the sub-display.

3. **Press the UP/DOWN key to display “SPAn” on the sub-display, and then press the ENT key.**
The instrument enters the menu for adjusting the compensation coefficient for cell constant. The sub-display starts blinking.

4. **Press the UP/DOWN key to set the compensation coefficient.**
UP key : Increments the value by 0.001.
DOWN key : Decrements the value by 0.001.
The setting range is 0.700 to 1.300.

5. **Press the ENT key.**
The compensation coefficient is updated. Now the adjustment for the compensation coefficient of cell constant (Span) has completed.

Tip

- **To abort the calibration, press the MEAS key. The instrument will return to the calibration menu without changing calibration data.**
- **To set another item in the calibration setting next, press the UP key to display it.**

4.4 Control value setup menu

This menu allows you to change the following control-related settings while performing measurements in the measurement mode.

Table 8 Contact output: setting items

Display	Item	Description	Reference	Remarks
dFct	Number of data used for moving average	Select the number of data used for moving average, which is performed to display measured values.	page 28	
1SEt	Control value	Set the control value, used as the criterion for switching the relay output ON/OFF.	page 36	*
1d iF or 1udF 1odF	Control width	Set the control widths: ● When the control width type is “d.diF”. Set the width (1.diF) from the control value at the center. ● When the control width type is “S.diF”. The width under the control value (1.udF) and the width over the control value (1.odF).	page 38	
1ond	Delay time (Relay ON)	Set the alarm output duration from the start until the C-NO contact output turns ON (unit: seconds)	page 39	
1oFd	Delay time (Relay OFF)	Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF (unit: seconds)	page 39	
2SEt	Control value	Set the control value, used as the criterion for switching the relay output ON/OFF.	page 36	
2d iF or 2udF 2odF	Control width	Set the control widths: ● When the control width type is “d.diF”. Set the width (2.diF) from the control value at the center. ● When the control width type is “S.diF”. The width under the control value (2.udF) and the width over the control value (2.odF).	page 38	
2ond	Delay time (Relay ON)	Set the alarm output duration from the start until the C-NO contact output turns ON (unit: seconds)	page 39	
2oFd	Delay time (Relay OFF)	Set the alarm clear duration from the cancellation until the C-NO contact output turns OFF (unit: seconds)	page 39	

*: For the options available for the selected control target, refer to “● Control targets and their available options” (page 32).

● **Operation**

1. **Press the MNT key in the measurement mode.**
   The sub-display shows “dFct”. (The measurement display keep showing a measured value.)
2. **Press the UP/DOWN key to display on the sub-display.**
   The setting items are displayed in the order shown in Table 8.
3. **Press the ENT key.**
   Now you can change the setting.
4. **Change the setting referring to the instruction page of the selected item.**

Tip

If you do not operate any keys for 10 seconds during item selection (step 2. mentioned above), this function is closed automatically (the display, returns to the normal measurement status).
During setting change (step 3. or later), this function is always open.

4.5 Security menu

This menu allows you two functions:
Key lock, to prevent accidental operation; and password lock, to prevent illegal operation.

4.5.1 Key lock

This function prevents accidental key operation, which may cause unintended setting change or hold output.

● **Set up**

1. **Hold down the MEAS key in the measurement mode displayed until "Lock" on the measurement display and "on" on the sub-display respectively.**
   The key lock displayed function starts working. Releasing the key lets the instrument return to the measurement mode, and the setup for the key locking is completed.
   No key operation is accepted hereafter and when any key is pressed, "Lock" is displayed on the measurement display and "on" on the sub-display respectively.

● **Release**

1. **Press the MEAS key when a measured value is displayed.**
   The instrument will display "Lock" on the measurement display and "on" on the sub-display.

Note

You cannot release the key lock immediately after key lock setup, with the displays showing "Lock" and "on". Make sure to start the release operation with a measured value displayed.

2. **Hold down the MEAS key in the measurement mode continuously until the display of the sub-display turns into "oFF" from "on".**
   When you release the MEAS key with "oFF" displayed on the sub-display, key lock release is completed.
   The instrument returns to the measurement mode, and now all keys are enabled.

4.5.2 Password locking

This function prevents illegal operation by unauthorized persons using the preset first and second passwords.
Each password is a 4-digit number.
When the password lock is enabled, the instrument performs measurement and rejects any key operations except for password lock setup (mentioned below).
You can enable/disable the lock only by following the procedure described below.

Note

- **Note that if the password locking is enabled, the maintenance functions such as calibration and settings are disabled. Set it up carefully.**
- **The password before factory shipment has been set to 0000-0000.**

● Password setting

You must input the current passwords before setting up new passwords.

Note

- **It is recommended to use numbers which is easy to remember and hard to forget.**
- **If you forget the passwords you set, send the instrument back to HORIBA Advanced Techno. We will send it back to you after resetting the passwords to the default setting (0000-0000). (Charged)**

1. **Perform the steps 1. to 5. of "Password Operation" (page 50).**
   Measurement display shows "Lock" and the sub-display shows the current lock status, "on" for enabled or "oFF" for disabled.
2. **Press the UP/DOWN key to select the password to be set.**
3. **Press the ENT key.**
   The instrument enters the setup state and the sub-display starts blinking.

Tip

To cancel the whole password setting and return to the measurement mode, press the MEAS key with a digit blinking.

4. **Press the UP/DOWN key to set a new password.**
5. **Press the ENT key.**
   The setting is established and the digit stops blinking.
   Then the next digit starts blinking.
6. **Repeat steps 4. to 5. to the rightmost digit.**
   When the rightmost digit is established, all the four digits flashes and the password is read into the instrument.
7. **To change the other password next, press the UP/DOWN key to select the other password, and change it in the same way.**

● Password Operation

1. **Hold down the UP key and DOWN keys at the same time in the measurement mode until "PASS" is shown on the main display.**
   When you release the buttons, the measurement display shows "PAS1", and the sub-display shows "0000" with the leftmost digit blinking. You can change the value of the blinking digit.

Tip

To cancel the whole password setting and return to the measurement mode, press the MEAS key with a digit blinking.

2. **Press the UP/DOWN key to select a value for the blinking digit.**
3. **Press the ENT key.**
   The setting is established and the digit stops blinking.
   Then the next digit starts blinking.
4. **Repeat steps 2. to 3. to the rightmost digit.**
   When the rightmost digit is established, all the four digits flashes and the first password is read into the instrument.
   And then the measurement display shows "PAS2" and the sub-display shows "0000".
5. **Input the second password in the same way.**
   When the two passwords are correct, the measurement display shows "Lock" and the sub-display shows the current lock status, "on" for enabled or "oFF" for disabled.

Note

If either of the passwords is wrong, the measurement display shows "PASS" and the sub-display shows "bad", and the instrument returns to the measurement mode.
The instrument does not tell you which password was wrong.

6. **If necessary, to change the setting press the ENT key.**
   The instrument enters the setup state and the sub-display starts blinking.
7. **Press the UP/DOWN key to set the password locking.**
   UP key: on:Enables the password lock.
   Down key:oFF: Disables the password lock.
8. **Press the ENT key.**
   The sub-display flashes, and the setting is established. The measurement display shows "Lock" and the sub-display shows the current lock status, "on" for enabled or "oFF" for disabled.
9. **Press the MEAS key to return to the measurement mode.**

4.6 User check menu

The user check menu allow you to check the instrument status, and to reset it to the default. Operate it from the user check menu.

● **How to open the user check menu**

Start the operation it from the measurement mode.

1. **Hold down the MNT key until the MNT lamp lights up.**
   The instrument enters the maintenance mode, and “SEt” is shown on the measurement display.
2. **Press the DOWN key to display “USr” on the measurement display, and then press the ENT key.**
   The instrument opens the user check menu, and “LEd” is shown on the sub-display.
   Refer to the below instructions for perform each of the available operations in accordance with the following description.

4.6.1 Status check

You can check the four items shown below.

- LEDs
- Transmission output
- Relay operation
- Measured value and temperature

● **Operation**

Perform the following operations after opening the user check menu.

● **LEDs**

1. **Press the UP/DOWN key, if necessary, to display “LEd” on the sub-display, and press the ENT key.**
   All the LED will light up normally.
2. **Check that LEDs light up without problems.**
3. **Press the MEAS key.**
   The instrument returns to the user check menu entrance.

● **Transmission output**

You can output an electric current of 4 mA, 12 mA and 20 mA from the transmission output.

1. **Press the UP/DOWN key to display “Cur” on the sub-display.**
2. **Press the ENT key.**
   “4-20” is shown on the measurement display and “4” on the sub-display outputting a 4 mA transmission output.
3. **To switch the current output, press the UP/DOWN key to select the value corresponding to the current (mA) to be output from 4, 12, or 20.**
4. **Check that the electric current is being output properly.**
5. **Press the MEAS key.**
   The instrument returns to the user check menu entrance.

● **Relay operation**

Check the operations of contact outputs R1 and R2.

Checking the contact output R1

1. **Press the UP/DOWN key to display “rLY” on the sub-display.**
2. **Press the ENT key.**
   “rLY1” is shown on the measurement display and “rLY” on the sub-display.
3. **Press the ENT key.**
   The relay lamp R1 lights up and the relay is turned on, normally.
   Press the ENT key to switch the relay ON/OFF to check the operation.
4. **Press the MEAS key.**
   The instrument returns to the user check menu entrance.

Checking the contact output R2

You can check R2 in the same way as R1. But, press the UP/DOWN key to display “rLY2” on the sub-display after the step 2.

● **Measured value and temperature**

1. **Press the UP/DOWN key in the user check menu to display “diSP” on the sub-display.**
2. **Press the ENT key.**
   The current measured value is shown on the measurement display and the current temperature on the sub-display.
3. **Press the MEAS key.**
   The instrument returns to the user check menu entrance.

4.6.2 Instrument reset

This operation allows you to initialize all the settings and restart the instrument.
Then perform the steps in “● Initial set up” (page 16) in the automatically opened basic setup menu.
Calibration values are also reset. Be sure to perform the steps in “4.3 Calibration” (page 43) before use.

● **Operation**

1. **Enter the user check menu referring to “How to open the user check menu” (page 51).**
   ”USr” is shown on the measurement display and “LEd” on the sub-display.
2. **Press the DOWN key to display “init” on the sub-display, and then press the ENT key.**
   The sub-display shows “no” and starts blinking.
3. **Press the DOWN key to select “YES”, and then press the ENT key.**
   The instrument is reset to the state before factory shipment.
   The sub-display shows “good” with flashing, and the instrument restarts.

Tip

- **The initial settings are shown in “Table 1 Basic setup items” (page 16).**
- **To return to the user check menu entrance without resetting, select “no” in step 3. and press the ENT key.**

5 For More Accurate Measurements

This is the maintenance information to keep the precision of this instrument and to use it better.

This chapter explains the maintenance to keep the precision of the instrument such as daily calibration.

5.1 Daily calibration (calibration mode)

Here we explain how to perform daily calibration.

● Precautions for calibration

- Do not reuse standard solution.
- The transmission output is put to the state set in the "● Hold output" (page 41) setting of the basic setup.
- Contact outputs are put to the following conditions:
  - Turned OFF when set to non, Cond or Err.
  - Turned ON when set to Hold, ON.
  - FAIL is output if a system error is raised when set to FAiL.

● Calibration operation

Operate it from the measurement mode.

1. **Hold down the CAL key until the CAL lamp lights up.**
   The calibration menu appears and the calibration type selected in the basic setup (automatic calibration or manual calibration) starts.
2. **Perform calibration in accordance with the method described in "4.3.1 Temperature calibration" (page 44).**

Tip

If you want to abort the calibration, press the MEAS key. The display returns to the measurement mode without updating the calibration data.

5.2 Maintenance for the instrument body

5.2.1 Inspection of the meter

If insulation of the terminals for connecting the sensor has been weakened, accurate measurement becomes difficult.

Inspect the terminal assembly periodically (once a year or so) to check for rust and the like that cause insulation to become weak.

Wipe out the dirt from the body case with soft cloth.

Prohibited

Do not use an organic solvent or something similar.

6 Troubleshooting

6.1 Troubleshooting

Problems	Causes or possibilities	Remedies
The measurement readout is unstable.	● Bubbles stick to the sensor. ● Bubbles appear because the flow rate is too fast. ● The level of the measuring solution has changed, and thus the area of the sensor that contact with liquid has changed. ● Rapid changes in liquid temperature. ● Screws of the terminal block are loose. ● Insulation of the terminal block has been weakened.	● Do not allow bubbles to appear in the measurement liquid. ● Control the flow rate. ● Install the instrument in a way that the level of the measuring solution does not change. ● Install the instrument in a place where liquid temperature does not change drastically. ● Tighten them securely. ● Drain the moisture of the terminal block. ● Clean the terminal block.
Abnormal value is displayed.	● The sensor is stained. ● The sensor is not soaked in the sample liquid. ● Disconnection or short circuit of the sensor cable ● Loose connection with the terminal block	● Wash the sensor. ● Install the instrument in a way that the level of the measuring solution does not change. ● Check the sensor cable. ● Check the terminal block.
Response is slow.	● The flow rates is slow. ● The uneven concentration of the measuring solution (when a tank has been installed)	● Increase the flow rate. ● Stir the sample well. ● Install it in a place where the concentration is even.
The instrument cannot be turned on.	● The power supply voltage is out of the rated voltage range. ● Wiring mistake ● Internal error of the instrument	● Check the power supply voltage. ● Check the wiring. ● Contact HORIBA Advanced Techno.

6.2 Out of the measurement range

When the measured value has exceeded the predefined measurement range, the sub-display shows “oF” with blinking.
If that happens, follow the instructions given below.

Code	Causes or possibilities	Remedies
oF (out of the measurement range)	The sensor is not soaked into the sample liquid.	Set the sensor in a way that it may be soaked in the sample liquid even if the level of the sample liquid changes.
	The protective cap of the sensor is placed on.	Remove the protective cap.
	● Wrong wiring for the sensor cable Especially, suspect disconnection of the G and R lines. ● Wrong wiring for the junction cable	Check if screws are loose or the wiring is wrong with the terminal block on the back of the instrument or the one of the relay box.
	The measurement range has not been set properly.	Set the measurement range suitable for the sample solution.

6.3 Error code

The instrument is equipped with the function to display various error codes.
Error codes are shown on the sub-display in a blinking state.

6.3.1 Description of error codes

Error code		Error	Description	Occurrence	Contact output
E-21	FAIL	Temperature sensor disconnected	The lead of the temperature sensor is broken.	At the time of measurement and calibration *2	Yes *3
E-22	FAIL	Temperature sensor short-circuited	The lead of the temperature sensor has been short-circuited.		
E-23	Error	Out of the temperature compensation range	The measured temperature is 110°C or more. *1		
E-24	Error	Out of the temperature compensation range	The measured temperature is 0°C or less. *1		
E-90	FAIL	System error	Initialization error	System error	Yes
E-91	FAIL	System error	The content of the memory such as set values and calibration values has been lost.		
E-92	FAIL	System error	Malfunction of the A/D converter		
AdoF	Error	Out of the ADC range	A/D converter scale over	At the time of measurement	Yes

*1: When the calculation method for temperature compensation has been set to “No temperature calibration”, no error is displayed since this error never arise.

*2: You cannot recalibrate the instrument when any of the errors E21 to E24 is found. Take necessary measures in accordance with “6.3.2 Remedies for error codes” (page 57).

*3: No contact output is generated during calibration.

Tip

- **Errors and FAILs can be output as an anomaly by setting the basic setup items.**
- **If any error code is displayed, the transmission output is preset to the value just before the error happens.**

6.3.2 Remedies for error codes

When an error code is displayed, take necessary actions in accordance with the table below.

Error code	Causes or possibilities	Remedies
E-21 (Temperature sensor disconnected)	Resistance error between T and T of the sensor.	The sensor is defective when the resistance value is within the range of 1 kΩ to 1.3 kΩ. Replace it with a new one.
	Wrong wiring of the sensor cable or junction cable	Check if the wiring is open between T and T.
E-22 (Temperature sensor short-circuit)	Resistance error between T and T of the sensor	Refer to the section on E-21.
	Wrong wiring of the sensor cable or junction cable	Check if the wiring is short-circuited between T and T.
E-23 (Out of temperature compensation range error)	Measured liquid temperature error (110°C or more)	Lower the temperature of the measured liquid to within the working temperature range of the sensor.
	Resistance error between T and T of the sensor	Refer to the section on E-21.
E-24 (Out of temperature compensation range error)	Measured liquid temperature error (0°C or less)	Lower the temperature of the measured liquid to within the working temperature range of the sensor.
	Resistance error between T and T of the sensor	Refer to the section on E-21.
E-90 E-91 E-92 (System error)	System error in the instrument	Turn the power OFF and turn it ON again. If the system error persists even after restarting the instrument, contact HORIBA Advanced Techno.
AdoF	Improper setting for temperature compensation	Check the parameters related to the cell constant and temperature compensation. Especially check to see if whether the calculation method for temperature compensation has been set to “PurE” for the measurement range other than 2 μS/cm. (When the deionized water characteristics has been set for solutions other than deionized water, measurements cannot be made correctly.)

7 Parts list

7.1 Options

Part names		Models	Specifications		Part codes
Sensor	Lead	ESD -001L-S	Short cell (cell length: 60 mm)	Cell constant (0.01/cm) Wetted material (SUS316) Lead length (10 m)	9110300100
		ESD -01L-S		Cell constant (0.1/cm) Wetted material (SUS316) Lead length (10 m)	9110301000
		ESD -1L-S		Cell constant (1.0/cm) Wetted material (SUS316) Lead length (10 m)	9110310000
	Connector	ESD -001C-S		Cell constant (0.01/cm) Wetted material (SUS316)	9110500100
		ESD -01C-S		Cell constant (0.1/cm) Wetted material (SUS316)	9110501000
		ESD -1C-S		Cell constant (1.0/cm) Wetted material (SUS316)	9110510000
	Lead	ESL -001L-S	Long cell (cell length: 110 mm)	Cell constant (0.01/cm) Wetted material (SUS316) Lead length (10 m)	9110400100
		ESL-01L-S		Cell constant (0.1/cm) Wetted material (SUS316) Lead length (10 m)	9110401000
		ESL-1L-S		Cell constant (1.0/cm) Wetted material (SUS316) Lead length (10 m)	9110410000
	Connector	ESL-001C-S		Cell constant (0.01/cm) Wetted material (SUS316)	9110600100
		ESL-01C-S		Cell constant (0.1/cm) Wetted material (SUS316)	9110601000
		ESL-1C-S		Cell constant (1.0/cm) Wetted material (SUS316)	9110610000

Part names		Models	Specifications		Part codes
Distribution type holder		EFA-30	ESD sensor (for short cells)	Wetted material (PVC) Measured solution temperature (0°C to 50°C) Measured solution pressure (0 MPa to 0.1 MPa)	9110101800
		EFA-30P		Wetted material (PVDF) Measured solution temperature (0°C to 100°C) Measured solution pressure (0 MPa to 0.1 MPa)	9110101900
		EFA-30S		Wetted material (SUS316) Measured solution temperature (0°C to 100°C) Measured solution pressure (0 MPa to 0.5 MPa)	9110102000
		EFA-31	ESL sensor (for long cells)	Wetted material (PVC) Measured solution temperature (0°C to 50°C) Measured solution pressure (0 MPa to 0.1 MPa)	9110102100
		EFA-31P		Wetted material (PVDF) Measured solution temperature (0°C to 100°C) Measured solution pressure (0 MPa to 0.1 MPa)	9110102200
		EFA-31S		Wetted material (SUS316) Measured solution temperature (0°C to 100°C) Measured solution pressure (0 MPa to 0.5 MPa)	9110102300
Extension cable	Lead	C-5C	Only for conductivity sensor. Specify your desired cable length.		9110105000
	Connector	CK-10M	Cable length 10 m		9110151000
		CK-20M	Cable length 20 m		9110152000
		CK-30M	Cable length 30 m		9110153000

7.2 Consumables

Part names	Specifications	Part codes
Fixture	The part attached at the time of the product purchase	9010900100
Terminal cover		9010900200
Gasket		9010900300

HORIBA Advanced Techno, Co., Ltd.
http://www.horiba-adt.jp

Headquarters
31 Miyanonishi-cho Kisshoin Minami-ku,
Kyoto-shi, 601-8306
TEL:+81-75-321-7184 FAX:+81-75-321-7291

Tokyo Office
Arute-Build Higashikanda. 4F, Higashikanda
1-7-8, Chiyoda-ku, Tokyo 101-0031
TEL:+81-3-3851-3150 FAX:+81-3-3851-3140

Nagoya Office
Sumitomo Seimei Chigusa Dai-ni Building 6F
3-15-31, Aoi Higashi-ku, Nagoya-shi, 461-0004
TEL:+81-52-937-0812 FAX:+81-52-937-0675

CODE:M500772A(I1002576000A) Ver.1 July, 2005
© 2005 HORIBA Advanced Techno, Co., Ltd.